TRANSLATION (HM-634PCT -- original):

WO 2004/050,271 A1

PCT/EP2003/012,790

ROLLING MILL WITH MEANS FOR CHANGING THE ROLLS

The invention concerns a rolling mill with several rolling stands and with support plates, which are provided on the operator side of the stands, can be moved transversely to the roll axes, are equipped for receiving sets of work rolls, and border on the mill floor. Pits are situated on the operator side upstream of each stand, and the bottom of each pit is equipped for moving out sets of backup rolls.

Rolling mills are known which have pits that are overlapped by transversely displaceable support plates, i.e., support plates that can be moved in the rolling direction or against the rolling direction. To change the work rolls, they are moved out of the rolling stands by roll-changing cylinders and set down on pairs of rails of the support plates. A new set of work rolls that has been set down on a parallel pair of rails of each support plate is pushed in front of each rolling stand by transverse displacement of the support plates. The roll-changing cylinders can then move the new sets of work rolls into

the stands. Tractors can take the used sets of work rolls, possibly after another transverse displacement of the support plates, and move them into the roll workshop. To accomplish a backup roll change, in which the sets of backup rolls are moved into the pits, the support plates are lifted by cranes and stacked. This takes a considerable amount of time.

To solve this problem DE 43 21 663 A1 proposes that the pits, which are arranged between the rolling stands and the transversely displaceable line of support plates, be provided with swiveling covers. These covers are situated in a horizontal position for a work roll change, whereas for a backup roll change, they are moved to unblock the pit to allow the sets of backup rolls to be moved in. In this previously known rolling mill with pits that are located between the rolling stand line and the support plate line and can be closed by covers, the work rolls must be moved over the covers and onto the support plates. The transverse displacement and the exchange of the work rolls do not occur until the work rolls are on the support plates. Therefore, the displacement distance is relatively long and a correspondingly large amount of time is required.

Proceeding on the basis of this prior art, the objective of the invention is to create a rolling mill in which both the work roll change and the backup roll change can be accomplished within a short time sequence, the roll change process can be more efficiently designed, and the production time of the plant can thus be increased.

This objective is achieved by an installation with the features of Claim 1. Advantageous modifications are described in the dependent claims.

The core of the invention lies in the fact that the support plates, which cover the pits directly next to the rolling stands and undertake the transverse displacement for the work roll change, can be partially or completely moved out of the pit area and thus out of the rolling stand area to carry out a backup roll change, either individually for a specific rolling stand or completely for the whole rolling train. For this purpose, the individual support plates are detachably connected with one another, so that optionally the entire support plate line or the support platform or only individual sets of support plates can be moved. This also makes it possible especially for individual rolling stands of a multiple-stand rolling mill to be equipped more quickly with new backup rolls. In addition, in the

position for making a backup roll change, the used or new work rolls can remain on the support plates. Consequently, this eliminates the additional changing time that would otherwise be required for each backup roll change.

The displacement area necessary for moving the support plate line is set in the mill floor. It can also be covered with a cover that forms the mill floor, so that the displacement area is available for other purposes, for example, as a set-down surface.

A very advantageous bolt-key connection is proposed for coupling the individual plates. It can be opened and locked especially with a special tool, which is described below.

The invention is explained in greater detail below with reference to the drawings.

-- Figure 1 shows a side view of a rolling mill with rolling stands and a support plate line arranged directly parallel to it with a displacement area for the support plates in the completely extended state of the support plate line or support platform.

-- Figure 2 shows a top view of the rolling mill in Figure 1.

-- Figure 3 shows a sectional view through the rolling mill.

-- Figure 4 shows a top view of the rolling mill in Figure 1 with the support plate line only partly extended.

-- Figure 5 shows the sectional view F-F in Figure 1 to illustrate the arrangement of the track rollers in accordance with a first embodiment of the displacement area.

-- Figure 6 shows a sectional view F-F to illustrate the arrangement of the track rollers in accordance with a second embodiment of the displacement area.

-- Figure 7 shows a side view of a second embodiment of the rolling mill with a displacement area for the support plate line below the mill floor in the extended state.

-- Figure 8 shows a side view of the rolling mill with detail of the foundation of the support plates.

-- Figure 9 shows a top view of the rolling mill in Figure 8.

-- Figure 10 shows the sectional view F-F of Figure 8.

-- Figure 11 shows the sectional view G-G of Figure 10.

-- Figure 12 shows a cross section of a connection of two abutting support plates with a bolt-key connection with a key extractor.

-- Figure 13 shows a sectional view of Figure 12 with the key extractor not yet in position.

Figure 1 shows a side view of a rolling mill 1 with six rolling stands (F1-F6), which are permanently anchored on a foundation 2. The rolling direction WR is indicated by an arrow. A shearing station 3 and a descaling station 4 can be installed upstream of the rolling mill 1. As Figure 2 illustrates, a support plate line 6 of individual support plates 7 is arranged on the operator side (BS) of the rolling mill and immediately adjacent and parallel to the rolling stand area 5 formed by the succession of individual rolling stands. The support platform, i.e., the totality of all support plates 7, consists of one support plate 7 per rolling stand F1-F6. For a work roll change, these support plates 7 are arranged above pits 8, which are located below the mill floor 9 (see Figure 3). The rolling stand area 5 is followed, as seen in the rolling direction WR, by the runout area 10 for the rolling stock. Parallel to this runout area 10, a displacement area 11 for the support plates 7 extends in continuation of the pit line. This displacement area 11, which is designed as a roller conveyor, is designed so long by its extension that all of the support plates 7 of the support plate line 6 can be moved in their entirety

from the rolling stand area 5 parallel to the runout area 10, and thus all pits 8 can be uncovered for changing the backup rolls 12. This extended state of the support platform is shown in Figures 1 and 2. 6' denotes the total displaced support platform.

The work roll change or backup roll change with transversely displaceable support plates 7 and pits 8 will be explained with reference to Figure 3.

A pit 8, at the bottom of which runout rails 13 for the sets of backup rolls 12 are installed, is located next to a rolling stand Fi, which is installed on a foundation 2. The runout movement is effected by a runout cylinder unit 15. For a work roll change, the respective pits 8 are covered with the support plates 7 in extension to the mill floor 9, and the support plates 7 are provided with suitable pairs of rails for moving the sets of work rolls 14 in and out. Tractors (not shown) pull the used work rolls 14' onto the support plates 7 and possibly back to the roll workshop. The transverse displacement of the support plates 7 for the work roll change is accomplished by means of a hydraulic cylinder 16 (see Figure 2). When it is time to carry out a backup roll change, the support plates 7 are moved out over the pits 8 transversely to the roll

axes and into the traversing area 11. The pits 8 are then available for running in the sets of backup rolls 12 or for changing the backup rolls.

In accordance with the invention, as Figure 4 shows, all the support plates 7 can be displaced in their entirety, or only subgroups 17 or subsets of support plates can be displaced to open the pit 8 of a desired individual rolling stand. To open the pit 8 of the fourth rolling stand F4 (shown here as an example), the support plates arranged after it in the rolling direction as well as the support plate assigned to the fourth rolling stand are moved as a set 17 by the length of one support plate in the rolling direction WR. The set of backup rolls 12 of the fourth rolling stand F4 can then be moved into the now open pit 8 and changed.

In the embodiment that has been discussed so far, the displacement area 11 for the displaced support plates 7 is arranged above the mill floor 18 after the rolling train. The mill floor 18 in the runout area is arranged at a sunken level about 350 mm below the mill floor 9 in the rolling stand area. In this regard, Figure 5 illustrates the arrangement of the carrying rollers 19 of the roller conveyor for conveying the support plates 7 in the displacement area 11. The carrying

rollers 19 are set in sunken tracks 20 in the foundation 2. Despite the carrying roller tracks 20, a relatively flat surface 21 is formed, over which vehicles can be driven, such as a truck or a mobile crane. The support platform as a whole is moved over these carrying roller tracks 20 and over the mill floor 18. The carrying rollers are preferably provided with a bilateral guide flange 22. In this variant with a sunken mill floor 18, although the displacement area 11 can be driven over by vehicles, it must always be kept free to allow the pits to be opened. To circumvent this, in another embodiment, the mill floor 23 in the displacement area 11 is raised relative to the mill floor 9 in the rolling stand area; in this case, the support plates 7 run over the carrying rollers 19 below the mill floor 23 along the carrying roller tracks 24, which are then open between the rollers 19 (see Figure 6). Figure 7 shows that the carrying roller tracks 24 are provided with a cover 25, so that the support plates 7 or the support platform can be moved under the cover 25. This makes it possible for the plane of the cover and thus the mill floor 23 above the displacement plane to be used for other purposes.

Figures 8 and 9 illustrate the foundation in the pit area 8 for realizing roller conveyors. In the illustrated example,

three track rollers 26 are mounted along the walls of each pit, which extend parallel to the roll axis, by means of bearing blocks 27 on the foundation 2. The bearing blocks 27 are located between the individual rolling stands Fi. In the transition from the rolling stand area 5 to the displacement area 11, there is a lantern pinion 28, which is an advantageous example of a possible drive mechanism. It is driven by a set of gears 29 of an electric motor 30 (see Figures 2, 10, and 11). The drive mechanism consists, for example, of a direct-current motor, a spur gear system, an electromagnetic toothed clutch, and a shaft, which drive the lantern pinion 28. The lantern pinion 28 engages mangle gearing 31 on the underside 32 of the individual support plates 7. To prevent the support plates 7 from tilting during the displacement movement, lateral guide rollers 33, which roll along the lateral surfaces of the plates 7, are provided. They are also mounted on bearing blocks 34.

To allow a displacement movement of the support plates 7 as a total set or support platform or as a subset, the support plates 7 must be detachably connected with one another. As Figure 12 illustrates, the abutting plate ends 35, 36 are coupled by means of an especially advantageous bolt-key connection. For this purpose, flanges 37, 38 are welded onto

the undersides of the plates, and each flange has a bore for receiving a common bolt 39. The bolt 39, which extends along the end regions 35, 36 of the plates, is passed through the flange 37 of one plate and fastened by screws 41, 42 with the aid of a holding plate 40 and projects beyond the plate end 35. Guide elements 43, which radially support the bolt 39 and are spanned with a locking plate 44, are mounted on the flange 37 itself. To connect two plates, the bolt 39 engages the flange 38 of the other plate. The second plate is positioned by means of a stop edge 45. Locking is then accomplished by inserting a key 48 into the projecting end 46 of the bolt 39, which is provided with a suitable receiving hole 47 for the key 48. To open the connection, the key 48 is removed and lowered into a key storage recess 49, which is set in the plate surface adjacent to the bolt 39. This bolt-key connection together with the key storage recess 49 offers a reliable and more or less trouble-free connection, which, in particular, is able to withstand the rough conditions in the rolling mill very well.

As Figure 13 also illustrates, a key extractor 50 is provided for opening the connection or removing the locking keys 48. This key extractor 50 consists of a hook 52, which is rotatably supported on a rod 51 or lever, and two withdrawing

rollers 53, 54 mounted below the pivot bearing. The withdrawing rollers 53, 54, which make contact with the plate 7, guarantee a large lever arm and a well-defined extraction point for the key 48.

The proposed rolling mill allows both a fast work roll change by a short transverse displacement of the support plates and a fast backup roll change by transverse displacement of the support plates out of the respective pit area or out of the entire rolling stand area into a displacement area provided for this purpose in the form of a roller conveyor. To this end, all of the support plates are connected with one another and thus provide a total support platform, which can be separated as required. The roll change is made with the aid of support plates that can be transversely displaced in the rolling direction.

List of Reference Symbols

1 rolling mill

2 foundation

3 shearing station

4 descaling station

5 rolling stand area

6 support plate line (6' displaced support platform)

7 support plates

8 pits

9 mill floor before the rolling mill and in the rolling stand area

10 runout area

11 displacement area

12 backup rolls

13 runout rails

14 work rolls (14' used work rolls)

15 runout cylinder unit

16 hydraulic cylinder

17 subgroups of support plates of the total platform 6'

18 sunken mill floor

19 carrying rollers

20 carrying roller track

21 flat surface

22 guide flange of the carrying rollers

23 raised mill floor

24 carrying roller tracks

25 cover

26 track rollers

27 bearing blocks

28 lantern pinion

29 set of gears

30 electric motor

31 mangle gearing

32 underside of a support plate 7

33 lateral guide rollers

34 bearing blocks of the lateral guide rollers

35 end of a plate 7

36 end of a plate 7 abutting the end 35 of a plate 7

37 flange on a plate

38 flange on a plate

39 bolt

40 holding plate

41 screw

42 screw

43 guide element

44 locking plate

45 stop edge

46 projecting end of the bolt

47 receiving hole in the bolt for the key

48 key

49 key storage recess

50 key extractor

51 rod

52 hook

53 withdrawing roller

54 withdrawing roller

Fi (F1-F6) rolling stands

WR rolling direction

BS operator side